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Canadian Science Advisory Secretariat
Science Response 2015/016

Gulf Region

INDICATORS OF ATLANTIC SALMON (*SALMO SALAR*) STOCK STATUS FOR PRINCE EDWARD ISLAND (SFA 17) AND GULF NOVA SCOTIA (SFA 18) IN DFO GULF REGION FOR 2014

Context

The last assessment of stock status for Atlantic Salmon in DFO Gulf Region was completed after the 2013 return year (DFO 2014). DFO Fisheries and Aquaculture Management (FAM) requested an update of the status of the Atlantic Salmon stocks in DFO Gulf Region for 2014. Indicators of abundance for adult and juvenile Atlantic Salmon from the salmon fishing areas of New Brunswick (SFA 15 and 16) are available in DFO (2015). This Science Response Report results from the Science Response Process of March 3, 2015 on Indicators for Atlantic Salmon for Gulf Nova Scotia and Prince Edward Island (SFA 17, 18).

Background

All rivers flowing into the southern Gulf of St. Lawrence are included in Fisheries and Oceans Canada (DFO) Gulf Region. Atlantic Salmon (*Salmo salar*) management areas in DFO Gulf Region are defined by four salmon fishing areas (SFA 15 to 18) encompassing portions of the three Maritime provinces (New Brunswick, Nova Scotia, and Prince Edward Island). SFA 17 consists of the province of Prince Edward Island and SFA 18 consists of the Nova Scotia portion of Gulf Region (Fig. 1).

For management purposes, Atlantic Salmon are categorized as large salmon (fish with a fork length equal to or greater than 63 cm) and small salmon (grilse; fish with a fork length less than 63 cm).

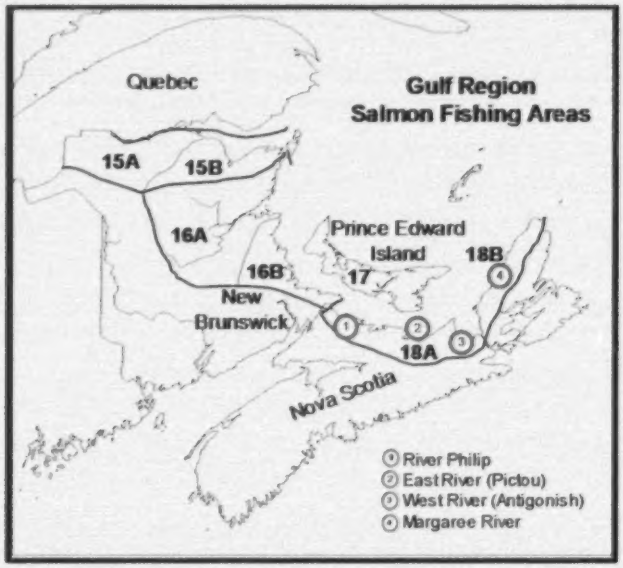

Figure 1. Salmon Fishing Areas (SFA) in DFO Gulf Region and location of rivers in Salmon Fishing Area 18A and 18B mentioned in this report.

Canada

Analysis and Response

Information on the percentage of the conservation requirements met in surveyed rivers of SFA 17 is provided. For SFA 18, recreational angling catches and indices of abundance based on catch per unit effort (rod day) from angler returned licence stubs are provided for the three index rivers of SFA 18A (West River (Antigonish), East River (Pictou) and River Philip) and for the Margaree River in SFA 18B. Estimated abundance of large salmon and small salmon and the proportion of the conservation requirement attained are also presented for the Margaree River. Indices of juvenile abundance are provided for the four index rivers of SFA 18.

Indices of adult salmon abundance

SFA 17

Salmon redds have been surveyed in all rivers in PEI that currently have salmon at least once since 1990. The methods for converting redd counts to female salmon spawners and assessing against attainment of river specific conservation requirements are described by Cairns and MacFarlane (2015).

There are 25 rivers in SFA 17 in which Atlantic Salmon occupancy has been confirmed at least once in 2008-2014, based on observations of redds or observations of juveniles (Table 1). Estimated spawning escapements exceeded conservation requirements in four of fifteen rivers which had complete surveys in 2014 (Table 1). All four rivers that exceeded conservation in 2014 also exceeded conservation in 2013, and are located on the northeast extremity of PEI (Fig. 2). On a number of rivers, adult salmon abundance has regularly been less than 50% of conservation. Population sizes in several smaller rivers are very small and reproduction does not appear to occur every year, based on single year classes of juveniles in rivers, and salmon in these rivers are considered at risk of extirpation.

Table 1. The percentage attainment of the Atlantic Salmon conservation requirements in monitored rivers of SFA 17 in 2008 to 2014. A dash indicates no survey was completed.

River	2008	2009	2010	2011	2012	2013	2014
Cains Brook	144[a]	-	-	139	102	95	-
Carruthers Brook	244[a]	-	-	472	210	157[a]	-
Trout River, Coleman	1[a]	-	-	-	-	24	15
Trout River, Tyne Valley	13	-	-	-	-	0	0
Little Trout River	24	42	20[a]	61	-	0	0[c]
Bristol (Berrigans) Creek	8	-	26	-	7	11	0
Morell River	79	-	-	108	58[a]	78[a]	93
Midgell River	50	85	-	80	59	26[a]	55
St. Peters River	55	-	-	55	73	46	45
Cow River	-	-	-	-	2	102	24
Naufrage River	107	34	35	459	46	484	232
Bear River	-	-	-	-	-	43	8
Hay River	-	-	-	2	5	78	27
Cross Creek	126	74	119	200	87	282	203
Priest Pond Creek	21[a]	15	26	37	39	283	242
North Lake Creek	195	208	200	346	103	325	178
Vernon River	0	-	-	-	5	7	5[a]
Clarks Creek	0	-	-	-	0	3	-
Pisquid River	37	-	36[a]	67	34	38	15[a]
Head of Hillsborough R.	0	-	-	0	0	2	-
North River	9	-	-	5	-	10	-
Clyde River	-	-	-	0	-[b]	-[b]	-[b]

River	2008	2009	2010	2011	2012	2013	2014
West River	44	15	27	28	27	52	35
Dunk River	5[a]	-	-	-	4[a]	-	-
Wilmot River	0	-	-	-	-	-	-[b]

[a] considered to be a minimum value due to incomplete survey coverage
[b] Juveniles were found by electrofishing in 2012 but not in 2013 and 2014.
[c] Juveniles were noted for the first time in 2014

Figure 2. Location of rivers (arrow symbols) for which redd counts were conducted in 2008 to 2014 and summary of the status of the rivers relative to the percentage of the conservation requirements attained in 2014, and in the most recent year assessed if not surveyed in 2014. The symbols are interpreted as follows: ↓ less than 90% of conservation requirements attained, ⇔ between 90% and 110% of conservation requirements, and ↑ greater than 110% of conservation requirements. The black symbols refer to the 2014 values whereas the brown symbols refer to the most recent value during 2008-2013 if not surveyed in 2014. The watershed blue shading refers to conservation having been met or exceeded in the most recent year assessed (including 2014), green shading refers to being less than conservation, and the brown shading are watersheds for which there has been no recent (since 2008) evidence of salmon being present.

SFA 18A

Indices of abundance from the recreational angling fishery for 2014 are preliminary and based on extracts from the licence stub return database to Feb. 25, 2015 (446 licence stubs returned out of 2,100 licences sold in 2014; 21% return rate). Catches and efforts from the returned licence stubs are raised to total licence sales to estimate total catch and effort.

The preliminary estimated catches of large salmon in the West River (Antigonish) and East River (Pictou) in 2014 were among the lowest values of the time series and below the long-term average (Fig. 3). The estimated catch in East River (Pictou) was the second lowest value of the time series. The catch of large salmon in River Philip in 2014 was similar to the long-term average.

The preliminary estimated catch per rod day of large salmon in 2014 was the lowest of the time series for East River (Pictou) and the second lowest for West River (Antigonish). Similarly low catch per rod day values were observed during 2000 and 2001 in East River (Pictou) and during 2007 and 2008 in West River (Antigonish). Low catch per rod day values were also observed in River Philip during those two time periods. Except for River Philip, the catch per rod day of large salmon in 2014 was below the long-term average.

The preliminary estimated catch of small salmon in West River (Antigonish) and East River (Pictou) were the lowest of the time series (Fig. 3). There was no reported catch of small salmon in East River (Pictou) in 2014 based on returned licence stubs. The estimated catch of small salmon in River Philip in 2014 was the third lowest of the time series. The estimated catches of small salmon in all three rivers in 2014 were five-fold lower than the long-term average.

The preliminary estimated catches per rod day of small salmon in 2014 were the lowest of the time series for the three rivers. The estimated catch per rod day of small salmon in 2014 was five-fold lower than the long-term average for the three rivers.

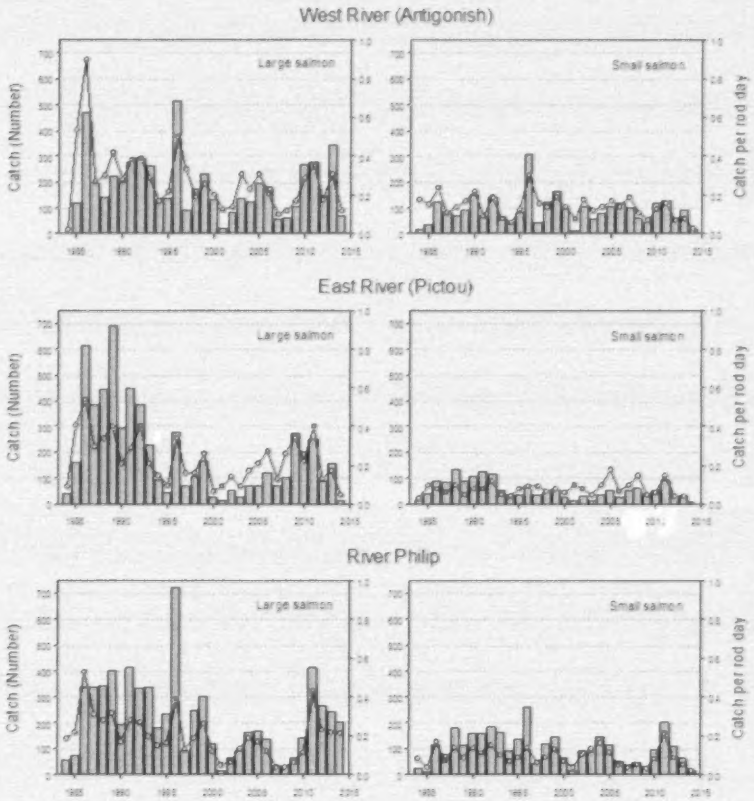

Figure 3. Estimated catches (bars) and catch per rod day (open circles) of large salmon (left panels) and small salmon (right panels) from the recreational fishery in the three largest rivers of SFA 18A, 1984 to 2014. The data for 2014 are preliminary.

SFA 18B

The estimated catch of large salmon in the Margaree River in 2014 was the third lowest value of the time series since 1984 and represented less than half the long-term average for the time series (Fig. 4). The estimated catch of small salmon in the Margaree River in 2014 was the second lowest value of the time series and was five-fold lower than the long-term average (Fig. 4). The lowest catch for both size groups in the Margaree River was in 2012.

The estimated catch per rod day of large salmon in the Margaree River in 2014 was comparable to the long-term average for the time series. The estimated catch per rod day of small salmon in the Margaree River in 2014 was similar to 2012 and was less than half the long-term average.

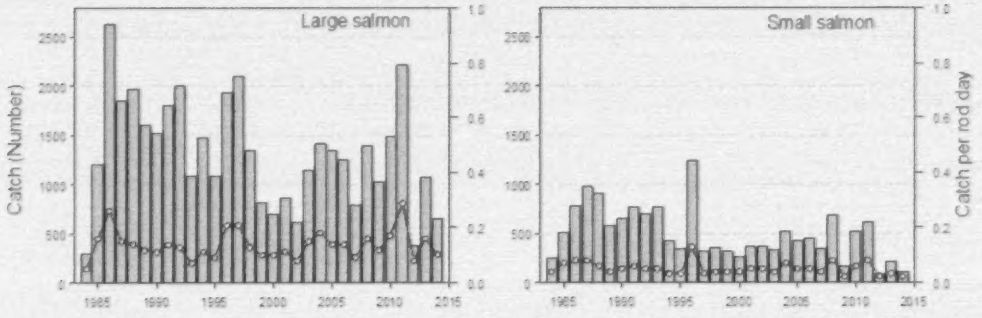

Figure 4. Estimated catches (bars) and catch per rod day (open circles) of large salmon (left panel) and small salmon (right panel) from the recreational fishery on the Margaree River (SFA 18B), 1984 to 2014. The data for 2014 are preliminary.

Adult salmon abundances for the Margaree River are derived with a model that uses estimates of exploitation rates in the recreational fishery. The exploitation rate values were derived using mark and recapture experiments conducted between 1988 and 1996, corresponding recreational fishery catch and effort data recorded in volunteer angler logbooks and licence stub returns as described in Breau (2013). Return estimates for 2014 are preliminary and based on license stubs entered to February 25 2015.

The estimated returns of large salmon to the Margaree River in 2014 were 1,840 fish (median; 95% confidence interval of 1,430 to 2,369) (Fig. 5), and below the long-term average of 2,879 fish. The estimated returns of large salmon in 2014 were the fourth lowest of the time series with 2012 being the lowest. Conservation requirements have been exceeded every year since 1987. The preliminary estimated returns of small salmon to the Margaree River in 2014 were 307 fish (median; 95% confidence interval of 202 to 458) (Fig. 5), and below the long-term average of 987 fish. The estimated returns of small salmon in 2014 were the second lowest of the time series with the lowest returns observed in 2012. The four lowest returns of large salmon were spread over the time series 1992 to present whereas for small salmon, the four lowest values were all in the last six years.

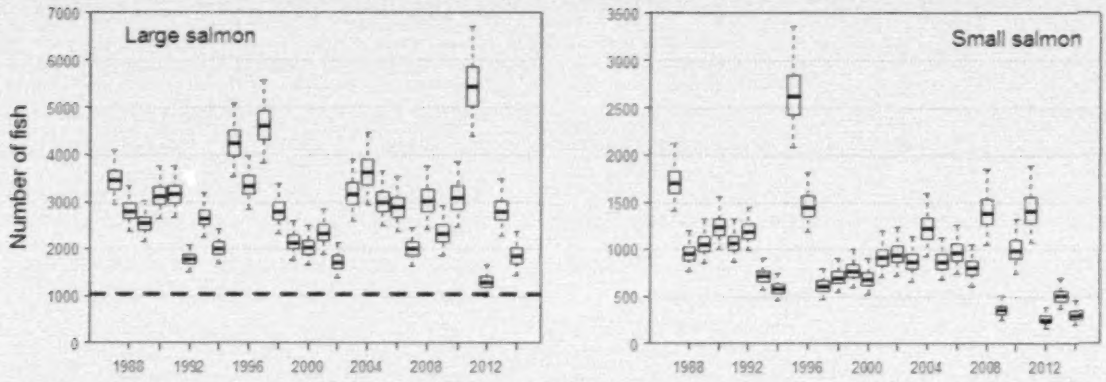

Figure 5. Posterior distributions of estimated returns of large salmon (left panel) and small salmon (right panel) to the Margaree River, 1987 to 2014. Values for 2014 are preliminary. Box plots are interpreted as follows: vertical line is the 90% credibility interval range, the rectangles are the interquartile range (50% credibility interval range) and the horizontal line in the rectangle is the median value. The dashed line in the left panel indicates the large salmon conservation requirement of 1,036 spawners.

Juvenile indices

Indices of freshwater production are derived from electrofishing surveys of juvenile salmon. Abundances at sites, in terms of number of fish per habitat area sampled by age or size group (densities), were obtained using successive removal sampling or catch per unit effort sampling calibrated to densities. Sampling intensities varied among years and among rivers.

SFA 18A

Juvenile salmon sampling surveys have been conducted in three index rivers in SFA 18A: West River (Antigonish), East River (Pictou), and River Philip. Results were presented for years with at least three sites sampled per river. Since 2012, six sites have been sampled per river. Two to three cohorts (fry, small parr, large parr) were captured at all sampling sites in 2014 indicating that there had been multiple years of spawning success. All sites sampled in 2014 were occupied by juveniles. Fry abundances have been at moderate to high levels (≥ 40 fry per 100 m^2) in all three rivers with a notable decline in recent years in West River (Antigonish) (Fig. 5). Parr abundances reflect the same pattern of annual abundances as fry, at moderate to high levels (≥ 20 fish per 100m^2) from the mid 1990s to mid 2000s, decline in abundance for West River (Antigonish), and generally lower abundances of parr in East River (Pictou) (Fig. 6).

SFA 18B

Thirteen sites were surveyed in the Margaree River in 2014. Two to three cohorts (fry, small parr, large parr) were captured at all sampling sites indicating that there had been multiple years of spawning success. All sites sampled in 2014 were occupied by juveniles. Fry and parr abundances have decreased since 2009 (except 2012) and remain low compared to earlier years (Fig. 7). The lower abundance of fry in 2011 was related to a 100-year flood event in December 2010. Results from juvenile surveys in 2013 showed decreased abundance which may have been related to the high water conditions during the surveys. Abundances in 2014 were the lowest value of the time series for parr and similar to recent years of low abundance for fry (Fig. 7).

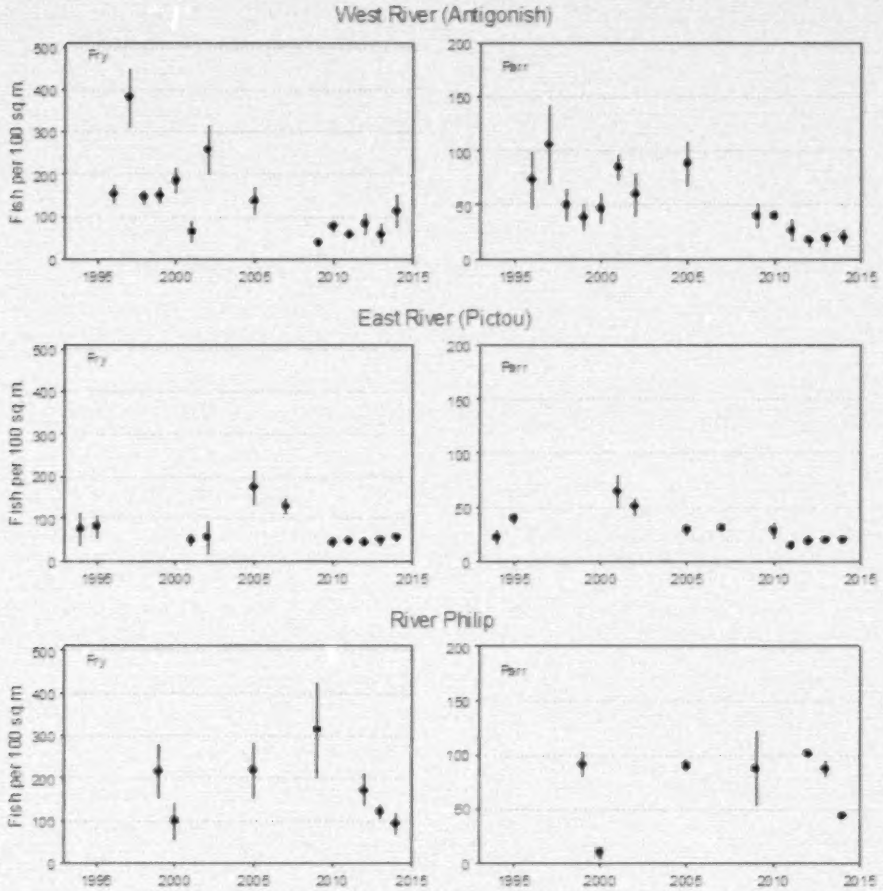

Figure 6. Mean juvenile Atlantic Salmon densities (fish per 100 m²) for fry (left panels) and parr (right panels) for sites sampled in the West River (Antigonish), East River (Pictou) and River Philip, 1994 to 2014. Only years for which at least three sites per river were sampled are presented. Vertical bars are one standard error.

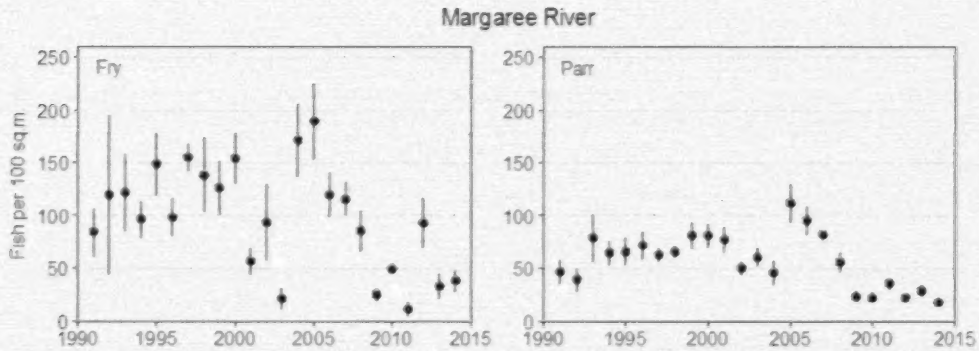

Figure 7. Mean juvenile densities (fish per 100 m²) for fry (left panel) and parr (right panel) for five sites sampled each year in the Margaree River, 1991 to 2014. Vertical bars are one standard error.

Conclusions

For SFA 17, the proportion of monitored rivers that exceeded the conservation requirements in 2014 (0.27; 4 of 15 rivers) was slightly lower than in 2013 (0.30; 6 of 20 rivers). Population sizes in several smaller rivers are very low and reproduction does not appear to occur every year, based on single year classes of juveniles in rivers, and salmon in these rivers are considered at risk of extirpation.

For SFA 18A, small salmon indices in 2014 were among the lowest of the time series beginning in 1984. For the Margaree River in SFA 18B, indices of small salmon abundance have been near record lows since 2012.

Large salmon abundance indices in the three index rivers of SFA 18A in 2014 were lower than those of 2013 and 2012. For the Margaree River in SFA 18B, large salmon indices and estimated abundance were lower than in 2013 but above the low values noted in 2012. The Margaree River was estimated to have exceeded its conservation requirement every year during 1987 to 2014.

Near record low small salmon abundance in 2014 in SFA 18A and the low abundance from 2012 to 2014 for the Margaree River (SFA 18B) are similar to the trends in abundance noted for the Gulf New Brunswick (SFA 15, 16) rivers (DFO 2015).

Juvenile abundance indices remain at moderate levels in four monitored rivers of SFA 18 although the abundance of juveniles in the West River (Antigonish; 18A) and the Margaree River (18B) have declined and remained at lower levels since 2009.

The striking feature in the stock status of salmon in Gulf Region for 2014 is the widespread low abundance of small salmon observed from 2012 to 2014 and the low abundance of large salmon in 2014 (DFO 2015). Recreational fisheries statistics for SFA 18 suggest the returns in the 2014 fishing season were low even compared to the low returns of recent years. Abundance of adult salmon in this region is constrained by low marine survival, which begins from the point of assessment in freshwater near the head of tide and ends with adult returns to the river one and two or more years later. The phenomenon of reduced marine survival is widespread for Atlantic Salmon stocks from eastern North America.

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Sources of information

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